

What is claimed is:

1 1. A test apparatus for visual display of audio parameters of multiple
2 audio channels of a signal, comprising:
3 an input to the test apparatus for receiving a signal comprising at least
4 three audio channels, wherein one of the audio channels at least temporarily
5 forms a reference channel for comparison by the test apparatus with at least
6 two other said channels, each of said at least two other channels at least
7 temporarily forming a relative channel for comparison of said audio parameters
8 between the relative channel and the reference channel;
9 an amplitude measurement circuit operable to determine a relative
10 amplitude of the relative channel versus the reference channel;
11 a phase comparator operable to determine a relative phase difference of
12 the relative channel versus the reference channel;
13 a visual display responsive to the relative amplitude and the relative
14 phase difference, wherein the relative amplitude and the relative phase
15 difference are presented on a same graphic plot on the visual display.

1 2. The test apparatus of claim 1, wherein the relative amplitude and
2 relative phase are presented in the graphic plot by positions plotted for audio
3 samples for the channels, a two dimensional plot for said relative channel
4 presenting relative amplitude and relative phase on different coordinates of the
5 graphic plot.

1 3. The test apparatus of claim 2, comprising a separate graphic plot
2 for each of at least two said relative channels.

1 4. The test apparatus of claim 3, further comprising a graphic display
2 of an absolute parameter for each of a plurality of channels of the signal,
3 wherein the separate graphic plots for said at least two relative channels are

4 respectively located to reference the graphic display of the absolute parameter
5 for a corresponding one of the relative audio channels.

1 5. The test apparatus of claim 2, comprising a graphic display having
2 a polar plot segmented to provide an area for plotting each of the relative
3 channels, wherein a phase difference between the respective relative channel
4 and the reference channel, is plotted to a radius of the polar plot in a segment
5 corresponding to each of the relative channels, and a relative amplitude of the
6 relative channel compared to the reference channel, is plotted to an angle with
7 respect to a reference angle in said segment.

1 6. The test apparatus of claim 5, further comprising a meter line for
2 plotting signal amplitude of each of the plurality of channels, the meter lines for
3 said plurality of channels being oriented to radiate from respective ones of the
4 segments, each of the meter lines substantially corresponding to the reference
5 angle in said respective one of the segments.

1 7. The test apparatus of claim 4, wherein the graphic display
2 contains a marker designating the reference channel, and wherein selection of
3 the reference channel from among the plural audio channels is changeable by a
4 user selection input.

1 8. The test apparatus of claim 1, further comprising a storage device
2 operable to store for a period of time a log representing at least one of values of
3 samples, relative amplitude and phase values, and processed data based on at
4 least one of the sample values and relative amplitude and phase values, and
5 further comprising at least a mode of the visual display wherein the log is
6 plotted.

1 9. The test apparatus of claim 8, wherein said at least one of the
2 relative amplitude and the relative phase values are reduced by at least one of

3 decimation and averaging, for providing alternative plots over different lengths
4 of time.

1 10. The test apparatus of claim 9, wherein at least two amplitude
2 values and at least one phase value are selectively displayable for a length of
3 time of at least one minute.

1 11. A test apparatus for displaying audio parameters for a plurality of
2 associated channels, comprising:

3 means for providing time sampled values of signals on the plurality of
4 channels;

5 a mathematical processing circuit operable to provide from the sampled
6 values at least one of an absolute amplitude value for each of at least two said
7 channels, and relative comparisons of at least one of amplitude and phase for
8 said at least two channels;

9 a display generator having at least one mode wherein the amplitude and
10 phase values of the at least two channels are simultaneously graphically
11 displayed.

1 12. The test apparatus of claim 11, further comprising a storage
2 device for storing at least one of the sampled values over time and processed
3 values derived from the sampled values over time, wherein the display
4 generator has at least one mode for displaying a time log of contents of the
5 storage device over time.

1 13. The test apparatus of claim 12, wherein the display generator is
2 operable to display a time period of at least one minute.

1 14. The test apparatus of claim 11, wherein the display generator is
2 configured to display selectively a plot of current data chosen from the group
3 consisting of absolute channel amplitude, relative channel amplitude between
4 identified channel pairs, relative phase between identified channel pairs, relative

5 channel amplitude versus any selected one of the channels, relative channel
6 phase versus any selected one of the channels, and a time plot of previous
7 channel amplitude and phase data.

1 15. The test apparatus of claim 11, wherein at least one mode of the
2 display generator includes a graphic plot wherein a relative amplitude and a
3 relative phase for at least one relative channel are presented in the graphic plot
4 by points plotted for audio samples for at least the relative channel and the
5 deemed reference channel, said graphic plot presenting a two dimensional plot
6 wherein said relative amplitude and said relative phase are plotted along
7 different axes.

1 16. The test apparatus of claim 11, comprising a graphic display of
2 signal amplitude versus a variable position along a line for each of a plurality of
3 said channels, wherein one of the relative amplitude and the relative phase for
4 at least the relative channel is plotted as a point along an extension of the line
5 and the other of the relative amplitude and phase is plotted as a point lateral to
6 the line.

1 17. The test apparatus of claim 16, wherein the lines plotting signal
2 amplitude for each of the plurality of channels are presented in a radiating
3 pattern relative to an origin, the lines being spaced radially from the origin by a
4 plot wherein the relative amplitude of at least two respective relative channels is
5 plotted as an angular deflection from a respective one of the lines, and the
6 relative phase of each respective channel is plotted along a line parallel to said
7 respective one of the lines.

1 18. The test apparatus of claim 15, wherein the lines plotting signal
2 amplitude for each of the plurality of channels are representing in a radiating
3 pattern space from the origin by a polar plot having angular sectors associated
4 with each of the lines plotting signal amplitude, each sector providing a polar
5 plot of the relative phase of the associated channel, represented as a radius

6 from the origin, and the relative amplitude of the associated channel,
7 represented as an angular deflection from the associated line representing
8 signal amplitude.

1 19. The test apparatus of claim 18, wherein the graphic display
2 contains a marker designating the reference channel, and wherein selection of
3 the reference channel from among the plural audio channels is changeable by
4 at least one user selection input.

1 20. A method for representing an audio signal having multiple
2 channels associated with a program, comprising the steps of:
3 providing digitized amplitude time samples for a plurality of said
4 channels;
5 at least temporarily deeming one of the channels as a reference channel
6 for at least two other of the channels as relative channels;
7 determining a relative amplitude of the relative channel versus the
8 reference channel;
9 determining a relative phase of the relative channel versus the reference
10 channel;
11 changing the channel deemed as the reference channel; and,
12 providing a display having at least one mode wherein at least one of:
13 the relative amplitude and relative phase are plotted for current
14 samples together with an absolute amplitude;
15 two of the absolute amplitude and one said relative phase is
16 plotted over a period of time.

1 21. The method of claim 20, further comprising:
2 displaying spatial line plots of signal amplitude in a pattern of varying
3 length lines corresponding to signal amplitude for each of a plurality of
4 channels;
5 displaying the relative amplitude and relative phase of at least one said
6 relative channel in a two dimensional plot in which the relative amplitude and

7 the relative phase are along different axes and the two dimensional plot is
8 associated with the corresponding spatial line plot for the at least one said
9 relative channel.

1 22. The method of claim 21, further comprising placing the spatial line
2 plots in a radiating pattern around an origin representing nominal speaker
3 positions for playback of the channels, spacing the spatial lines plots by a radial
4 distance from the origin, and plotting in the radial distance a polar plot of
5 relative amplitude and relative phase for at least two said relative channels.

1 23. The method of claim 22, further comprising providing said polar
2 plot for a plurality of relative channels, the respective polar plot for a given
3 channel being plotted in an angular sector substantially aligned with an
4 associated one of the line plots.

1 24. The method of claim 23, wherein relative phase between zero and
2 180° is plotted to a distance from the origin in the angular sector, and relative
3 amplitude is plotted as circumferential displacement along an angle above and
4 below an angle of the associated one of the line plots.

1 25. The method of claim 24, further comprising presenting as an
2 alarm condition a distinct color representation of points having a relative phase
3 that is within a predetermined phase difference of 180° .